REMARKS

Claims **1-18** are pending. By this amendment, claim 1 is amended. Applicants submit that the above amendment is not provided for reasons of patentability and is not a narrowing amendment. Applicants respectfully request reconsideration and timely withdrawal of the pending objections and rejections for the reasons discussed below.

Drawings

Formal drawings were filed on June 2, 2004. Applicants submit these drawings are sufficient to overcome all the objections noted in the Notice of Draftsperson's Patent Drawing Review dated May 3, 2004. Accordingly, Applicants request withdrawal of the drawing objections.

35 U.S.C. § 112, Second Paragraph, Rejection

Claim 1 is rejected under 35 U.S.C. § 112, second paragraph as not providing antecedent basis for the limitation "the first source and drain regions." Claim 1 is amended to recite "the first source and drain extension regions."

This amendment is made for the sole purpose of clarifying claim 1, and is not made for the purpose of avoiding prior art or narrowing the claimed invention. Thus, no change in claim scope is intended, and Applicants do not intend to relinquish any subject matter by the amendment. Applicants respectfully submit that claim 1, as amended, fully complies with the requirements of 35 U.S.C. § 112, second paragraph, and respectfully request withdrawal of the rejection of claim 1.

35 U.S.C. § 103 Rejection

Claims **1-18** are rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicants' admitted prior art (AAPA), in combination with U. S. Patent No. 6,372,590 issued to Nayak, *et al.* ("Nayak") This rejection is respectfully traversed.

A rejection under 35 U.S.C. § 103(a) requires the Examiner to first establish a *prima facie* case of obviousness: "The examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness. If the examiner does not produce a prima facie case, the applicant is under no obligation to submit evidence of nonobviousness." M.P.E.P. § 2142. The Court of Appeals for the Federal Circuit has set forth three elements which must be shown for prima facie obviousness:

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claims 1-6 and 12-18

Claim 1 recites in pertinent part:

> ... reducing vacancy concentration in the source and drain extension regions to decrease diffusion of the N type impurity contained in the first source and the drain extension regions.

Claims 2-6 and 12-18 depend from independent claim 1. Applicants submit that a *prima facie* case of obviousness has not been established because the combination suggested by the Examiner does not show all the features of the claimed invention. For example, neither AAPA

nor Nayak teach or suggest reducing a vacancy concentration in a source and drain extension regions of a semiconductor device, as claimed.

First, the Examiner's rejection cuts a wide swath, randomly gathering and grouping selected elements of several of Applicants' dependent claims within the boundaries of independent claim 1. By way of example, it was stated at page 3 of the Office Action:

> AAPA fails to teach forming source and drain extension regions in the upper surface of substrate and implanting nitrogen into the source and drain extension regions.

Remarkably, none of Applicants' claims recite this particular limitation. Respectfully, it is the elements of the claims themselves – not the Examiner's summary interpretation of them -- that is to be compared with relevant teachings of the related art. Most importantly, however, the AAPA teaches away from the claimed invention by noting, in pertinent part:

> Here, the excessive amount of vacancies contained in the SiGe layer undesirably increases diffusion of the implanted N type impurity....

Thus, nothing in the AAPA teaches elements of the claimed invention, as suggested by the Examiner.

Continuing on, the Examiner further correctly notes that AAPA does not teach forming source and drain regions in the upper surface of the substrate and implanting nitrogen into the source and drain extension regions. However, the Examiner then notes that:

> Nayak teach [sic] forming n-type source and drain extension regions in an upper surface of an [sic] substrate and then implanting nitrogen with implantation dose of 1×10^{14} to 5×10^{15} atoms/cm^2 and implantation energy or 1KeV to 100 KeV into the source and drain extension regions to reduce series resistance and hot carrier effects. (See the abstract of Nayak.)

The Examiner concludes it would have been obvious to one skilled in the art to combine Nayak's teachings with those of the AAPA in order to obtain the claimed invention.

Applicants agree that Nayak discloses an implantation dose of 1×10^{14} to 5×10^{15} atoms/cm^2 and implantation energy or 1KeV to 100 KeV into the source and drain extension regions. But this implantation is to reduce series resistance and hot carrier effects. However, claim 5 recites an energy level of .3 KeV to 100 KeV. Also, claim 3 , for example, additionally recites F, Xe, Ar, He, Kr or a noble gas element, in addition to N. These features are not taught in Nayak. Additionally, Nayak uses a P-well which is different than that disclosed in the invention. In fact, Nayak merely mentions that the diffusion does not increase, which does not mean a decrease in diffusion, as recited in the claims. Also, there is no explicit teaching of the elements of claim 1, which recite reducing vacancy concentrations in source and drain regions to decrease diffusion of a N-type impurity.

The Examiner further suggested that Nayak's abstract teaches the subject matter of claim 1. However, a careful review fails to verify (i) that Nayak's abstract teaches the specificities stated by the Examiner or (ii) that Nayak as a whole teaches any of the novel subject matter recited by claim 1. For example, nothing in Nayak's abstract or specification explicitly teaches reducing vacancy concentration in source and drain extension regions to decrease a diffusion of a N-type impurity contained therein, as claim 1 recites.

In fact, Nayak addresses problems different than those addressed by the claimed invention. For example, Nayak references diffusion only generally, stating:

> ... the present invention does not result in any significant increase in S/D extension overlap as compared to conventional dopants...[1]
>
> ... the nitrogen implant of the present invention does not increase lateral diffusion of the dopant in any significant manner...[2]

Significantly, neither the word "vacancy," nor the phrase "decrease diffusion," nor the phrase "vacancy concentration," appear at any point in Nayak's specification. Also, Nayak teaches reducing hot electron carrier and punch through effects, which is not directed to solving the same problems as the present invention. Accordingly, there is no motivation to combine Nayak with the AAPA. Thus, the features of claim 1 are not present in Nayak.

As mentioned above, and admitted by the Examiner, the AAPA does not teach reducing vacancies to decrease diffusion. Consequently, even if a motivation to combine the AAPA with Nayak existed, the resultant combination would not disclose each and every element of claim 1. For these reasons, Applicants submit that claim 1 is allowable over the cited references. Claims 2-18 depend on claim 1, and are allowable for at least the same reason as claim 1, as well as for their added features.

Claims 7-11

Regarding claims 7-11, the Examiner admits, at page 3 of the Office Action, that Nayak does not disclose the features of these claims. However, the Examiner makes an unsubstantiated assertion that:

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[1] Column 5, lines 63-65

[2] Column 6, lines 60-62

> ... it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal value or range for the depth for the peak concentrations of the implanted nitrogen and impurity through routine experimentation and optimization to obtain optimal or desired device performance because the relative depths of the nitrogen and impurity are result-effective variables and there is no evidence indicating that they are critical or produce any unexpected results and it has been held that it is not inventive to discover the optimum working ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144. 05.

Applicants respectfully disagree with the Examiner's statements. Specifically, Applicants' invention is not to be limited to a conventional implantation of nitrogen as asserted by the Examiner. Depending on the embodiment, any number of interstitial or vacancy-trapping elements may be used to decrease diffusion. None of the remaining features of the dependent claims are shown as suggested by the references. For example, Applicants' specification provides evidence that the relative depths of the interstitial or vacancy-trapping elements are not result-effective. For example, paragraph 17 states, in pertinent part:

> The concentration peak of the implanted interstitial element or vacancy-trapping element can be near the N type impurity peak so as to maximize the diffusion retardation.

This is more than mere experimentation. In fact, Applicants submit that this would not have been known by those of ordinary skill in the art without knowing and reading Applicants' own disclosure. This would be unreasonable and impermissible hindsight reasoning. This is only buttressed by the fact that Nayak does not even address the same problems, solutions, or objects of the invention. With this said, one of ordinary skill in the art would not know to use the specificities as claimed after reading Nayak.

Additionally, it is not proper to take official notice of facts without citing a prior art reference where, as in this case, the facts asserted are not capable of instant and unquestionable demonstration as being well-known. *See*, MPEP 2144.03. Thus, pursuant to MPEP 2144.03, Applicants respectfully request that the Examiner either provide documentary evidence or withdraw the rejection.

Claims 9 and 10

Claim 9 depends from claim 4, and recites, in pertinent part:

> ... the method of claim 4, further comprising a step of annealing.

Claim 10 depends from claim 9, and recites in pertinent part:

> ... wherein the step of annealing is performed at a temperature of approximately 700° C to 1200 ° C for approximately 1 second to 3 minutes.

With regard to these claims, the Examiner asserted that:

> ... annealing is well-known to one of ordinary skill in the art of making semi-conductor devices.
>
> With respect to claim 10, the annealing temperature and duration are result-effective variables and there is no evidence indicating that they are critical or produce any kind of unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Applicants respectfully disagree with the Examiner's assertions. As specifically taught by paragraph 21 of Applicants' specification, annealing, as well as the annealing temperatures and

duration, are not result-effective variables, as the Examiner suggests. For example, paragraph 21 recites, in pertinent part:

> Annealing is performed to activate the implanted impurity and cure the implantation damage arising from implanting the interstitial element or a vacancy-trapping element and source and drain implants.

This is only buttressed by the fact that Nayak does not even address the same problems, solutions, or objects of the invention. With this said, one of ordinary skill in the art would not know to use the specificities as claimed.

Claim 11

The rejection of this claim is moot because claim 11 depends from allowable claim 1, which recites novel elements not taught in the AAPA or in Nayak.

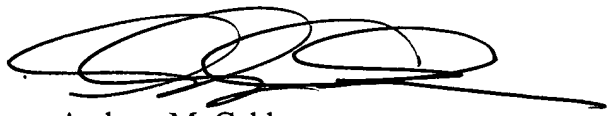
For the reasons set forth above, a *prima facie* case of obviousness over claim 1 has not been established. Claim 1 is thus distinguishable over the references of record and is in allowable condition. Claims 2-18 are allowable at least for the reasons discussed above with respect to independent claim 1 from which they depend, as well as for their added features.

Accordingly, Applicants respectfully request that the rejection of claims 1-18 be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicants hereby make a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to **IBM Deposit Account No. 09-0458** (Fishkill).

Respectfully submitted,



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